生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	展開的葉片迅速閉合 (Stretched leaves power rapid closure)
生物系統 LIVING SYSTEM	捕蠅草 *Dionaea muscipula* (Venus flytrap)
功能類別 FUNCTIONS	#捕捉、吸收、或過濾生物 #改變大小/形狀/質量/體積 #機械能轉型 #Capture, absorb, or filter organisms #Modify size/shape/mass/volume #Transform mechanical energy
作用機制標題	捕蠅草展開的葉片透過儲存機械使陷阱迅速閉合 (Stretched leaves of the Venus flytrap power rapid trap closure by storing mechanical energy)
生物系統/作用機制示意圖	

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

捕蠅草 (*Dionaea muscipula*) 透過引誘獵物到葉片中間再迅速捕捉，比起肌肉運動，這種植物透過改變葉片形狀來儲存機械位能 (mechanical energy)，在需要觸發陷阱關閉時可以釋放出來。

在陷阱開啟的時候，捕蠅草會展開其葉片，然後這種延展會以彈力能 (elastic energy) 的形式儲存機械位能。當陷阱被觸發而突然閉合時，葉片中水分運動釋放儲存的能量，造成陷阱把獵物夾住。如同作者 Yoël Forterre 解釋：「本質上來說，葉片會展開直到到達不能再維持的不穩定狀態，就像放開一個反折的塑膠蓋子或切開的網球，每片葉子都能折回原本的樣子，變回原來的形狀，把獵物夾在葉子中間。」

The Venus flytrap (*Dionaea muscipula*) has to rapidly capture prey by ensnaring it between its leaves. Instead of using muscles to create movement, this plant changes the shape of its leaves to store potential mechanical energy that can be released when it needs to trigger trap closure.

While the trap is opening, the plant stretches its leaves back on themselves, and this stretching stores potential mechanical energy in the form of elastic energy. When the trap is

triggered to snap shut, hydraulic movement in the leaves releases the stored energy, causing the trap to snap closed over its prey. As author Yoël Forterre explains: “In essence, a leaf stretches until reaching a point of instability where it can no longer maintain the strain. Like releasing a reversed plastic lid or part of a cut tennis ball, each leaf folds back in on itself, and in the process of returning to its original shape, ensnares the victim in the middle.”

文獻引用 (REFERENCES)

「捕蠅草 (*Dionaea muscipula*) 葉片以大約 100 ms 速度迅速閉合，是植物界其中一種最快的運動，這令達爾文稱它為『世界奇觀之一 (one of the most wonderful in the world)』。」(Forterre 2005: 421)

「這個要從細胞到器官層面增加活動跟速度的問題，被大自然這個完美的液壓 (hydraulic) 工程師巧妙的解決了，表現了如何控制幾何學上細長物件的彈力不穩定性，提供了常見動物肌肉力量運動之外的另一個想法。」(Forterre 2005: 425)

「本質上來說，葉片會展開直到到達不能再維持的不穩定狀態，就像放開一個反折的塑膠蓋子或切開的網球，每片葉子都能折回原本的樣子，變回原來的形狀，把獵物夾在葉子中間。」

“The rapid closure of the Venus flytrap (Dionaea muscipula) leaf in about 100 ms is one of the fastest movements in the plant kingdom. This led Darwin to describe the plant as ‘one of the most wonderful in the world’”. (Forterre 2005: 421)

“This ingenious solution to the problem of scaling up movements and speed from the cellular to the organ level in plants, nature’s consummate hydraulic engineers, shows how controlling elastic instabilities in geometrically slender objects provides an alternative to the more common muscle-powered movements in animals.” (Forterre 2005: 425)

“In essence, a leaf stretches until reaching a point of instability where it can no longer maintain the strain. Like releasing a reversed plastic lid or part of a cut tennis ball, each leaf folds back in on itself, and in the process of returning to its original shape, ensnares the victim in the middle”.

參考文獻清單與連結 (REFERENCE LIST)

Forterre, Y., J. M. Skotheim, J. Dumais, and L. Mahadevan. (2005). How the Venus flytrap snaps. *Nature* 433: 421-425. (https://www.nature.com/articles/nature03185)

Graham S. (January 27, 2005). Secret of the Venus fly trap revealed. *Scientific American.* (https://www.scientificamerican.com/article/secret-of-the-venus-fly-t/)

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/Venus_flytrap
撰寫/翻譯/編修者與日期
譚國鎏翻譯 (2020/04/06)；林冠辰翻譯 (2020/04/27)；許秋容編修 (2020/11/25)；紀凱容編修 (2020/11/25)
AskNature 原文連結
https://asknature.org/strategy/stretched-leaves-power-rapid-closure/