

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	外殼保護、支持並允許成長 (Shell protects, supports, and allows for growth)
生物系統 LIVING SYSTEM	軟體動物 (Molluscs)
功能類別 FUNCTIONS	#應付撞擊 #改變大小、形狀、質量、體積 #形狀/材料最佳化 #物理性組成結構 #保護免受動物危害 #Manage impact #Modify size/shape/mass/volume #Optimize shape/materials #Physically assemble structure #Protect from animals
作用機制標題	許多軟體生物的外殼有保護及支撐的功能，同時因為外殼的錐形構造使其可以容納持續成長的身體 (The shells of many mollusks provide protection and support while accommodating growth due to their conical structure)
生物系統/作用機制示意圖	 <p>The image displays a variety of mollusk shells, including conical, spiral, and bivalve shells, illustrating the biological strategy of shell growth. The shells are arranged in a grid-like pattern, showing different colors and textures. A small inset image shows a collection of shells on a rocky beach.</p>
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
文獻引用 (REFERENCES)	
「試想能滿足以下情況的形狀，能為生物提供支持與保護，該形狀必須是中空的，但要有一個開口。它的增長只能透過疊加物質在內層表面或游離的邊緣。伴隨著成長的過	

程，殼的形狀僅能有小小的改變。有一面開口的立方體外殼無法滿足成長條件，因在外殼壁增加物質會使相對於其容量的外殼比重增加；而圓柱狀外殼也無法滿足，因為在外殼邊緣延伸會使它從短胖變成相對細長。只有圓錐狀的殼才能達成成長的條件，無論是圓形的或橢圓的錐形都可以。在邊緣延長或使外殼壁加厚都可以使整個錐體更大，與原本的殼形成等距 (isometric) 的情況。

因只有些微的等距 (isometry) 條件變化，所有圓錐形的衍生物都可以達成以上條件，因此這些形狀被有殼軟體動物所使用。」 (Vogel 2003: 88-89)

“Consider shapes that satisfy the following set of conditions. To provide both support and protection for the organism, the shape must be a hollow one, but an opening must exist somewhere. Growth can occur only by addition to the inner surface or the free edge. And the shape should change only minimally as it grows. A cubic shell with an open face won't work: addition to walls will give more shell relative to its contained volume, and addition to cylinder doesn't meet the conditions—addition to the edge will move it from short and fat to long and (relatively) thin. What will work are cones, whether circular or elliptical. Add to the edge and thicken the walls and one gets a bigger cone, isometric with the original.

With only slight variations of the condition of isometry, all sorts of wild derivatives of cones are possible—and these latter are the shapes in which shelled mollusks occur.” (Vogel 2003: 88-89)

參考文獻清單與連結 (REFERENCE LIST)

Vogel, S. (2013). *Comparative biomechanics: life's physical world, second edition*. Princeton University Press.

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/Mollusca>

https://www.onezoom.org/life/@Mollusca=802117?img=best_any&anim=flight#x392,y293,w0.5808

<https://eol.org/pages/2195>

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AskNature 原文連結

<https://asknature.org/strategy/shell-protects-supports-and-allows-for-growth/>