

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	改變身體硬度 (Body changes stiffness)
生物系統 LIVING SYSTEM	豹斑海參 <i>Bohadschia argus</i> (Leopard sea cucumber)
功能類別 FUNCTIONS	#改變材料特性 #Modify material characteristics
作用機制標題	海參透過硬化、塑化因子及滲出海水使身體從柔軟變得堅硬 (The body of the sea cucumber changes from soft to standard to hard due to stiffening and plastizing factors and exuding water.)
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>「棘皮動物的僵固結締組織 (Catch connective tissue) 或稱為可變膠原組織 (mutable collagenous tissue)，可以透過神經系統在幾分鐘內大大改變其機械性特質例如彈性 (elasticity) 及黏性 (viscosity)。組織中含有大量的細胞外基質 (extracellular matrix)，通常為膠原纖維 (collagen fibril)、蛋白聚醣 (proteoglycan) 及微纖維 (microfibril) 所組成。這些膠原組織的獨特性質可能是由於膠原纖維及周圍的細胞外基質並不會有永久連結，因為膠原纖維很容易從僵固結締組織中分離出來——並不同於成年脊椎動物的膠原組織。看來膠原纖維與鄰近相同分子及細胞外基質其他構成物的交互連結，會在僵固結締組織的機械性質改變時形成或是解除。然而這些變動的分層機制尚未完全解開。海參的體壁表面是一層典型的僵固結締組織，在受到不同刺激時能進行迅速而可逆的機械性特質變化。對於海參 (<i>Actinopyga mauritiana</i>) 表皮動態的機械性特質，大量的研究指出其組織能表現出至少三種狀態，分別稱為堅硬、普通及柔軟狀態，可以從彈性及黏性特質，還有拉扯行為區分... 普通狀態下的機械參數並不單是堅硬及柔軟狀態之間的中間數值，顯示從柔軟狀態轉換到堅硬狀態跟從普通狀態轉換到堅硬狀態的分子機制有所不同。」 (Yamada et al. 2010: 3416)</p> <p>“Catch connective tissues or mutable collagenous tissues of echinoderms can extensively change their mechanical properties such as elasticity and viscosity within a few minutes under</p>	

the regulation of their nervous system. The tissues contain a large amount of the extracellular matrix, mainly consisting of collagen fibrils, proteoglycans and microfibrils. The unique properties of these collagenous tissues might be due to lack of permanent associations between the collagen fibrils and the surrounding extracellular matrix because it is easy to isolate collagen fibrils from catch connective tissues – unlike collagenous tissues of adult vertebrates. It seems that crosslinking of the collagen fibrils with adjacent ones and other components of the extracellular matrix is formed or broken during changes in the mechanical properties of catch connective tissues. The molecular mechanisms underlying the change are, however, not yet fully understood. The holothurian body wall dermis is a typical catch connective tissue that shows rapid and reversible changes in its mechanical properties in response to various stimuli. Extensive studies on the dynamic mechanical properties of the dermis of the sea cucumber *Actinopyga mauritiana* revealed that the tissue can adopt at least three different states. These are stiff, standard and soft states, which can be distinguished by elastic and viscous properties and by strain-dependent behaviors...The mechanical parameters of the standard state are not simply the intermediate values between the stiff and the soft states, suggesting that the molecular mechanism converting the soft to the standard state is different from that converting the standard to the stiff state.” (Yamada et al. 2010: 3416)

參考文獻清單與連結 (REFERENCE LIST)

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延伸閱讀

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生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)
https://en.wikipedia.org/wiki/Holothuria
撰寫/翻譯/編修者與日期
譚國鎔翻譯 (2020/04/07); 蒲宥辰翻譯 (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/body-changes-stiffness/