

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	蛋白質賦予組織終生彈性 (Protein gives lifetime elasticity to tissues)
生物系統 LIVING SYSTEM	人類 (Human)
功能類別 FUNCTIONS	#應付擠壓 #應付張力 #改變材料特性 #Manage compression #Manage tension #Modify material characteristics
作用機制標題	科學家已經解開了賦予人體組織彈性特性，並產生出近乎完美彈性分子的蛋白質形狀訊息 (Scientists have unraveled the shape of the protein that gives human tissues their elastic properties, and generating a molecule with near-perfect elasticity.)
生物系統/作用機制 示意圖	

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

科學家已經解開了賦予人體組織彈性特性的蛋白質形狀的訊息，這可能有助開發出新的合成彈性聚合物...彈性蛋白 (elastin) 可以使人類和其他哺乳動物的組織伸展，例如當肺部呼吸時的收縮和擴張，或動脈在心跳過程中變寬和變窄超過十億次。這項研究...在迄今工程尚未能製造出了能終生持續的、近乎完美的分子情況下，取得了勝利。彈性蛋白高水平的物理性能，大大超過所有人造橡膠 (橡皮筋)，並且更持久。它是由許多原彈性蛋白 (tropoelastin) 組合到彈性蛋白中所協調而成的裝配體，賦予組織伸展特性，這種精緻的裝配體有助於生成彈性組織，如動脈、肺部和皮膚。我們發現原彈性蛋白是一個彎曲的、類似彈簧的分子，具有一個「腳部」區域，可以促進附著在細胞上。拉伸和放鬆實驗顯示該分子具有非凡的能力，可以延伸到其初始長度的八倍，然後可以恢復到其原始形狀而不會損失能量，使其成為接近完美的彈簧。

Scientists have unraveled the shape of the protein that gives human tissues their elastic properties in what could lead to the development of new synthetic elastic polymers...Elastin allows tissues in humans and other mammals to stretch, for example when the lungs expand and contract for respiration or when arteries widen and narrow over the course of a billion heart beats. The study...has triumphed where engineering has so far failed by generating a molecule with near-perfect elasticity that will last a lifetime. "This high level of physical performance

demand of elastin vastly exceeds and indeed outlasts all human-made elastics. It is the coordinated assembly of many tropoelastins into elastin that gives tissues their stretchy properties and this exquisite assembly helps to generate elastic tissues as diverse as artery, lung and skin. We discovered that tropoelastin is a curved, spring-like molecule with a 'foot' region to facilitate attachment to cells. Stretching and relaxing experiments showed that the molecule had the extraordinary capacity to extend to eight-times its initial length and can then return to its original shape with no loss of energy, making it a near-perfect spring.

文獻引用 (REFERENCES)

彈性蛋白能夠使彈性組織發生可逆的變形，並可以承受反覆的力量達數十年。原彈性蛋白是彈性蛋白的可溶性前驅物，為哺乳動物中發現的主要彈性蛋白...原彈性蛋白是一種不對稱的線圈，具有突出的腳...我們呈現了個別的原彈性蛋白分子具有高度延展性，具備彈性但無遲滯現象 (hysteresis)，可表現如高效率的分子奈米彈簧。我們的發現揭示了生物學如何利用這種單一蛋白質去建構持久的，並允許細胞接附到一附加腳上的彈性結構。

Elastin enables the reversible deformation of elastic tissues and can withstand decades of repetitive forces. Tropoelastin is the soluble precursor to elastin, the main elastic protein found in mammals...Tropoelastin is an asymmetric coil, with a protruding foot...We show that individual tropoelastin molecules are highly extensible yet elastic without hysteresis to perform as highly efficient molecular nanosprings. Our findings shed light on how biology uses this single protein to build durable elastic structures that allow for cell attachment to an appended foot.

參考文獻清單與連結 (REFERENCE LIST)

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延伸閱讀

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

https://www.onezoom.org/life/@biota=93302?img=best_any&anim=flight#x634,y815,w1.0435
<https://en.wikipedia.org/wiki/Human>

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AskNature 原文連結

<https://asknature.org/strategy/protein-gives-lifetime-elasticity-to-tissues/>