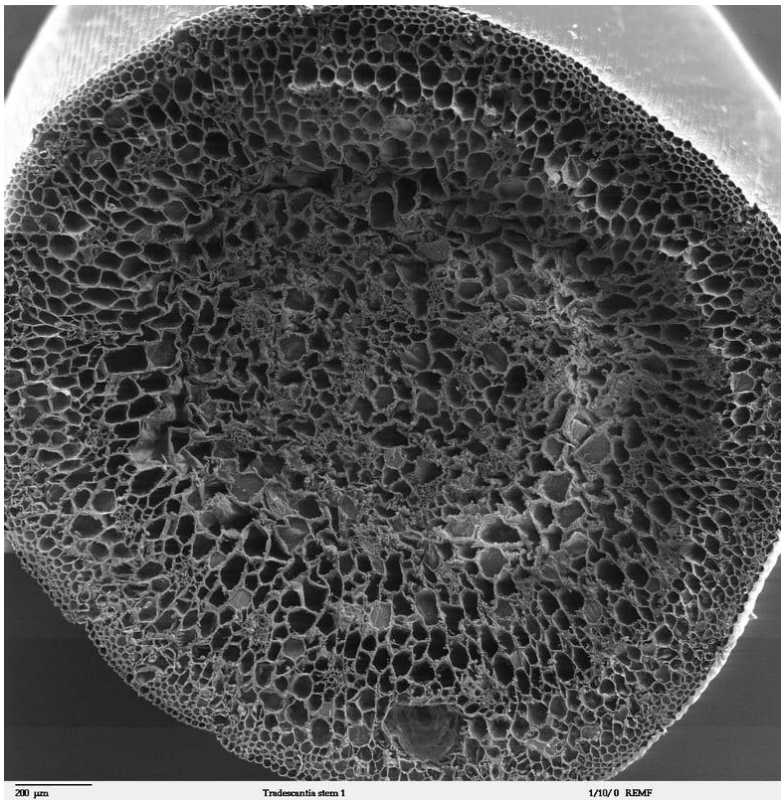
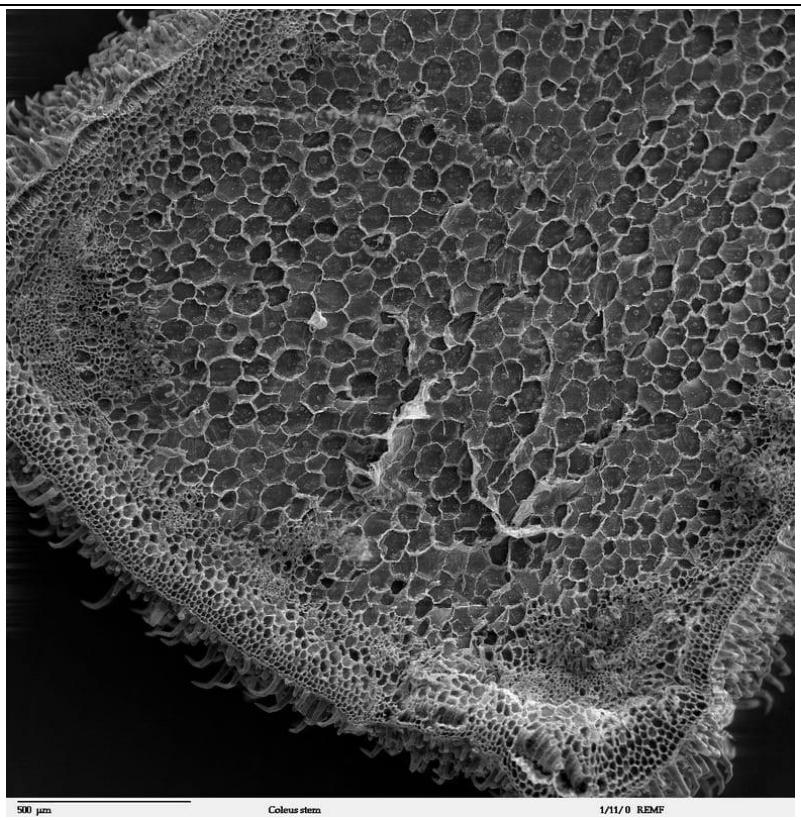
生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	桿狀加固提供強度 Rod-like Reinforcements Provide Strength
生物系統 LIVING SYSTEM	植物 Plants
功能類別 FUNCTIONS	#分配液體　　#管理壓縮 #Distribute Liquids　　#Manage Compression
作用機制標題	植物中的維管束提供機械強度，作為桿狀增強物。 Vascular bundles in plants provide mechanical strength, serving as rod-like reinforcements.
生物系統/作用機制示意圖 (確認版權、註明出處；畫質)	 圖一: 圓葉鴨跖草 (*Tradescantia virginiana*) 莖的橫切面的掃描電子顯微鏡圖像。圖像顯示環狀的維管束，具有中央髓。



圖二: 彩葉草 (*Coleus blumei*) 莖的橫切面的掃描電子顯微鏡圖像。圖像顯示表皮外層、皮層、環形的維管束和中央髓。

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

當一個生命系統受到壓縮時，有一股力在推動它，就像一把椅子上有一個人坐在上面一樣。當均勻地應用於活動系統的所有側面時，壓縮會導致體積減小。當應用於兩側時，它會導致變形，例如在氣球的兩側推動時。這種變形可以是暫時的，也可以是永久性的。由於生命系統必須保持其最有效的形式，因此它們必須確保任何變形都是暫時的。管理壓縮還提供了減輕其他力影響的機會。生命系統用策略來防止壓縮或從中恢復，同時保持功能。例如，非洲成年象的體重從 4，700 到 6，048 公斤不等。因為他們必須在四隻腳上承受所有這些重量，所以他們的腳組織具有使壓縮能夠吸收和分配力的特徵。

液體包括水，以及體液，如血液，胃液，富含營養的液體等。為了生存，許多生命系統必須在自身內部或位置之間移動這些液體。由於其特性，液體傾向於分散，除非它們以某種方式受到限制。為了解決這個問題，生命系統有策略來限制流體進行運輸，並克服重力，摩擦力和其他力等障礙。其中一些相同的障礙也提供了機會。樹木和長頸鹿面臨著同樣的挑戰：如何在重力作用下向上移動液體（分別是水和血液）。但他們的策略卻截然不同。樹木使用毛細管作用和蒸發來移動水，可能是由於水的極性和附著力。長頸鹿緊繃的皮膚提供壓力以協助血液迴圈，並防止血液積聚在腿部。

植物莖的機械強度是由位在具有較薄壁細胞基質中的維管束所提供，有點像是桿狀增強物。每個維管束都有一個纖維的外鞘，形成一個堅固的管子，其中兩個寬的導管即可以傳導水，並且薄壁狹窄的細胞（韌皮部）鏈可以運輸糖溶液，幾乎沒有損壞的風險。就

在較小導管的外環的內側，幾層狹窄的細胞最終變得厚壁，並以圓柱體的形式為整個莖提供額外的強度。

When a living system is under compression, there is a force pushing on it, like a chair with a person sitting on it. When evenly applied to all sides of a living system, compression results in decreased volume. When applied on two sides, it results in deformation, such as when pushing on two sides of a balloon. This deformation can be temporary or permanent. Because living systems must retain their most efficient form, they must ensure that any deformation is temporary. Managing compression also provides an opportunity to lessen the effects of other forces. Living systems have strategies to help prevent compression or recover from it, while maintaining function. For example, African elephant adults weigh from 4,700 to 6,048 kilograms. Because they must hold all of that weight on their four feet, the tissues of their feet have features that enable compression to absorb and distribute forces.

Liquids include water, as well as body fluids such as blood, gastric juices, nutrient-laden liquids, and more. To survive, many living systems must move such liquids within themselves or between locations. Because of their properties, liquids tend to disperse unless they are confined in some way. To address this, living systems have strategies to confine fluids for transport, and to overcome barriers such as gravity, friction, and other forces. Some of these same barriers also provide opportunities. Trees and giraffes face the same challenge: how to move fluids (water and blood, respectively) upward against gravity. But their strategies are quite different. The tree moves water using capillary action and evaporation, possibly due to water's properties of polarity and adhesion. The giraffe's tight skin provides pressure to assist in blood circulation. and keep blood from pooling in the legs.

Here mechanical strength of the stem is provided by the vascular bundles set in a matrix of thinner-walled cells, rather like rod reinforcements. Each vascular bundle has an outer sheath of fibres, forming a strong tube in which the two wide vessels can conduct water, and the strand of thin-walled, narrow cells (phloem) can transport sugar solutions with little risk of damage. Just to the inner side of the outer ring of smaller vessels the several layers of narrow cells eventually become thick-walled and provide additional strength in the form of a cylinder to the whole stem."

文獻引用 (REFERENCES)

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參考文獻清單與連結 (REFERENCE LIST) **Harvard 或 APA 格式**

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

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AskNature 原文連結

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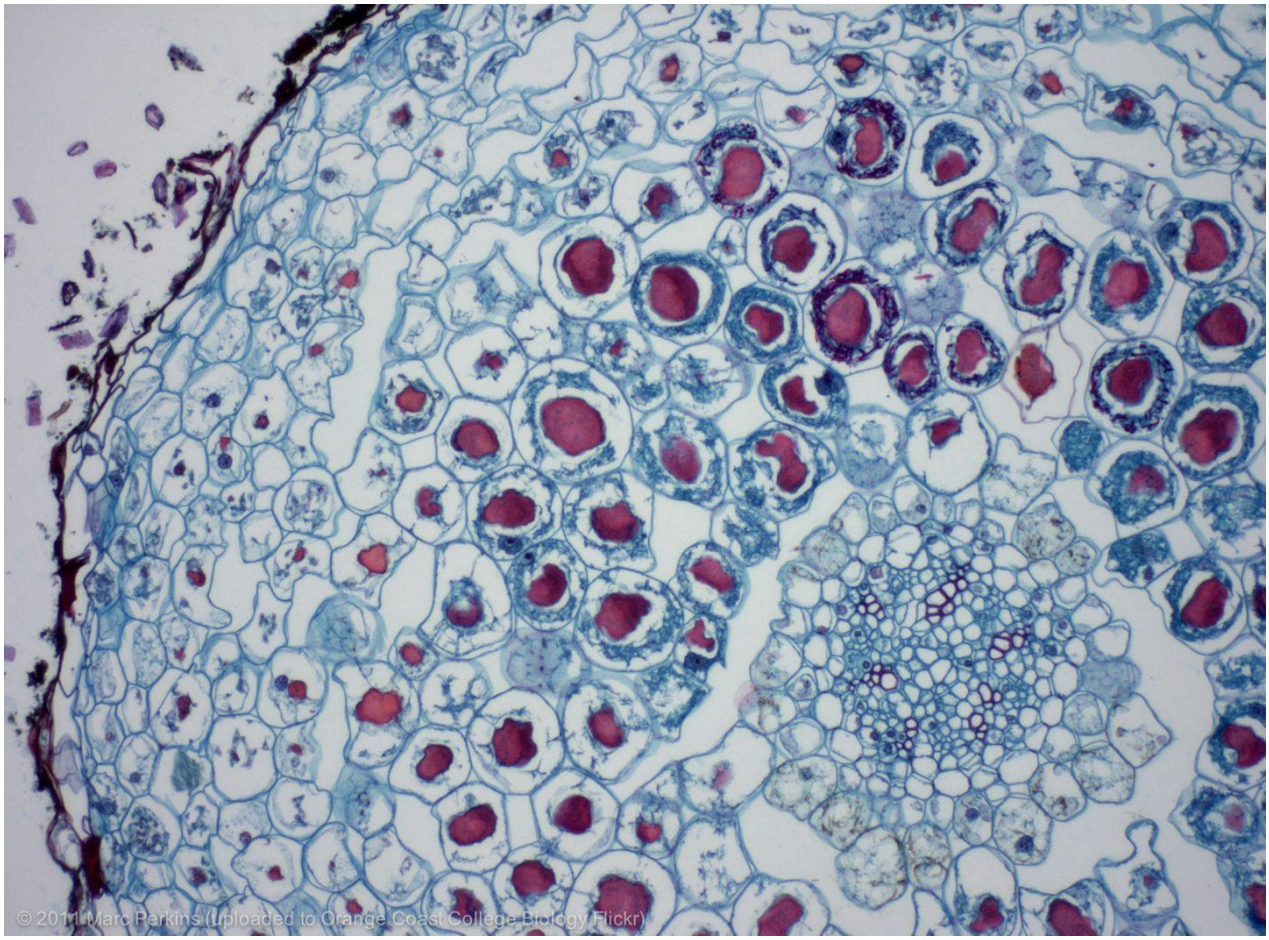

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