

生物策略表

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| <p>類別</p> | <p>生物策略 (Strategy)</p> |
| <p>生物策略 STRATEGY</p> | <p>淋巴系統是如何在沒有幫浦的情況下進行泵送的 (How the Lymph System Pumps With No Pump)</p> |
| <p>生物系統 LIVING SYSTEM</p> | <p>哺乳動物 (Mammals)</p> |
| <p>功能類別 FUNCTIONS</p> | <p>#捕獲、吸收或過濾有機體 #捕獲、吸收或過濾液體 #分配液體 #防止微生物 #Capture, absorb, or filter organisms #Capture, absorb, or filter liquids #Distribute liquids #Protect from microbes</p> |
| <p>作用機制標題</p> | <p>淋巴系統使用壓力、肌肉收縮和單向閥通過血管網絡擠壓液體，而無需泵。(The lymphatic system uses pressure, muscle contractions, and one-way valves to squeeze fluid through a network of vessels without the need for a pump.)</p> |
| <p>生物系統/作用機制 示意圖 (確認版權、註明出處；畫質)</p> | <div data-bbox="564 801 1361 1682" data-label="Diagram"> <p>The diagram, titled "LYMPHATIC CIRCULATION", illustrates the relationship between the lymphatic system and the circulatory system. It features a central heart with four chambers. The pulmonary circuit (red) connects the heart to the lungs, and the systemic circuit (blue) connects it to the rest of the body. The lymphatic system is shown in green, with lymphatic capillaries and vessels that collect tissue fluid from both the pulmonary and systemic capillary beds. A lymph node is shown as a cluster of lymphatic vessels. Arrows indicate the direction of fluid flow: from tissue fluid into lymphatic capillaries, through lymphatic vessels and valves, and back into the systemic venous circulation near the heart.</p> </div> <div data-bbox="616 1686 1251 2002" data-label="Image"> <p>This microscopic view shows the structure of a lymphatic vessel wall. It consists of a single layer of endothelial cells, which are flattened and joined at their ends to form one-way valves. These valves prevent the backflow of fluid, ensuring that lymph moves in only one direction through the vessel.</p> </div> <p>出處: VectorMine/643×720 pixels/720×367 pixels</p> |

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

淋巴液通過壓力差、肌肉收縮和單向閥的組合流過身體。像血管一樣，淋巴毛細血管滲透到身體的大部分組織中。淋巴毛細血管細胞相互重疊，就像封閉百葉窗中的水平板條一樣。隨著液體在毛細淋巴管外的組織中積聚，壓力增加並推動重疊的細胞，使它們稍微向內打開。廢物通過間隙進入淋巴管，從而減輕外部壓力。隨著毛細淋巴管外的壓力降低，皮瓣再次關閉，將液體困在裡面。

就像水自然地從高壓流向低壓一樣，毛細淋巴管中的高壓推動液體通過系統。此外，當周圍的肌肉在運動過程中收縮時，它們會壓縮淋巴管並將液體向前推。作為補充，較大的淋巴管本身在其外壁上有平滑肌細胞，有助於擠壓推動液體的血管。與構成心臟的肌肉細胞的集中集合不同，分佈在整個淋巴管中的平滑肌細胞僅在需要時收縮——有時強烈而突然，有時呈層疊式波浪 (cascading wave)。

在整個系統中，淋巴管內的單向瓣閥可防止回流並使液體沿一個方向移動——流向稱為鎖骨下靜脈 (subclavian vein) 的頸部靜脈。在鎖骨下靜脈，淋巴廢物進入血液，可以重複使用或經由肝臟和腎臟過濾。

Lymph fluid flows through the body using a combination of pressure differences, muscle contractions, and one-way valves. Like blood vessels, lymphatic capillaries permeate most of the body's tissues. Lymphatic capillary cells overlap one another like the horizontal slats in closed window blinds. As fluid accumulates in tissue outside of lymphatic capillaries, the pressure increases and pushes on the overlapping cells, opening them slightly inwards. The waste material enters the lymphatic vessels through gaps, which relieves the external pressure. As the pressure outside the lymphatic capillaries reduces, the flaps close again, trapping the fluid inside.

Just as water flows naturally from high to low pressure, higher pressure in the lymphatic capillaries propels fluid through the system. In addition, as surrounding muscles contract during motion, they compress lymphatic vessels and push the fluid forward. Complementing that, larger lymph vessels themselves have smooth muscle cells on their outer walls that help squeeze the vessels that propel the fluid. In contrast to the centralized collection of muscle cells that make up the heart, smooth muscle cells distributed throughout the lymphatic vessels contract only as needed—sometimes strongly and suddenly, and sometimes in a cascading wave.

Throughout the system, one-way flap valves inside lymph vessels prevent backflow and keep the fluid moving in one direction—towards veins in the neck called subclavian veins. At the subclavian veins, the lymph waste products enter the bloodstream and can either be reused or filtered through the liver and kidneys.

文獻引用 (REFERENCES)

「周圍組織對淋巴管的循環壓縮和擴張以及由 SMC (平滑肌細胞) 的自發階段性收縮產生的內在泵力調節淋巴推進。」

“Cyclical compression and expansion of lymphatic vessels by surrounding tissues and intrinsic pump forces generated by the spontaneous phasic contraction of SMCs (smooth muscle cells) regulate lymph propulsion.”

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

JOURNAL ARTICLE Lymphatic vascular morphogenesis in development, physiology, and disease Journal of Cell Biology | 2011 | Stefan Schulte-Merker, Amélie Sabine, and Tatiana V. Petrova

[Journal of Cell Biology:607-618\(https://research.wur.nl/en/publications/lymphatic-vascular-morphogenesis-in-development-physiology-and-di\)](https://research.wur.nl/en/publications/lymphatic-vascular-morphogenesis-in-development-physiology-and-di)

延伸閱讀: Harvard 或 APA 格式 (取自 AskNature 原文; 若為翻譯者補充, 請註明)

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

https://asknature.org/?s=&p=0&hFR%5Bpost_type_label%5D%5B0%5D=Biological%20Strategies&hFR%5Btaxonomies_hierarchical.system.lv10%5D%5B0%5D=Animals%20%3E%20Vertebrates%20%28Mammals%2C%20Fish%2C%20Birds%2C%20Reptiles%29%20%3E%20Mammals

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AskNature 原文連結

<https://asknature.org/strategy/how-the-lymph-system-pumps-with-no-pump/>