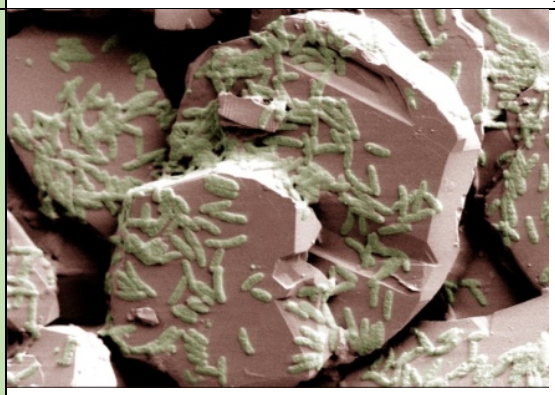
生物策略格式

KJC, 2019/10/21

類別	生物策略 (Strategy)
生物策略 STRATEGY	細菌還原氧化鐵 (Bacteria reduce iron oxide)
生物系統 LIVING SYSTEM	希瓦氏菌 *Shewanella oneidensis*
功能類別 FUNCTIONS	#獲取、吸收、或過濾化學物質 #化學性分解無機化合物 #改變氧化態 #Capture, absorb, or filter chemical entities #Chemically break down inorganic compounds #Modify oxidation state
作用機制標題	希瓦氏菌藉由兩種蛋白質附著並在厭氧條件下還原氧化鐵 (*Shewanella oneidensis* bacteria attach to and reduce iron oxide in anaerobic conditions via the work of two proteins.)
生物系統/作用機制示意圖	

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

希瓦氏菌 (*Shewanella oneidensis*) 透過將其自身附著在固體礦物中的氧化鐵顆粒上，並利用其中包含的氧分子來「呼吸」。這要歸功於兩種蛋白質。當環境氧氣低時，希瓦氏菌表現這些蛋白質，蛋白質結合並還原氧化鐵。（由 Biomimicry Guild 提供）

Shewanella oneidensis "breathes" by attaching itself to particles of iron oxide found in solid minerals, and utilizing the oxygen molecules contained therein. It is thanks to two proteins that this can occur. When ambient oxygen is low, *S. oneidensis* expresses these proteins, and the proteins bind to and reduce iron oxide. (Courtesy of the Biomimicry Guild)

文獻引用 (REFERENCES)

「從這些測量得到的能量值 [以阿焦耳 attojoule（10^{-18}焦耳）] 顯示，在厭氧條件下希瓦氏菌和針鐵礦 (goethite) 之間的親和力迅速增加了 2 至 5 倍，預期在厭氧條件下電子會從細菌轉移到礦物質。由力圖曲線中的特定標記意指推定的 150 千道爾頓鐵還原酶在希瓦

氏菌的在外膜內被固定，並且專一性地與針鐵礦表面相互作用以促進電子轉移過程。」(Lower et al. 2001: 1360)

「我們已經證明在厭氧條件下，希瓦氏菌透過在界面處快速形成更強的黏附能量來對針鐵礦表面反應。我們解釋這些數據指出在認定針鐵礦作為末端電子受體後，希瓦氏菌積極地移動和/或產生與礦物表面專一性相互作用的蛋白質（推定 150-kD 的還原酶和或許其他者）。」(Lower et al. 2001: 1363)

"Energy values [in attojoules (10^{-18} joules)] derived from these measurements show that the affinity between *S. oneidensis* and goethite rapidly increases by two to five times under anaerobic conditions in which electron transfer from bacterium to mineral is expected. Specific signatures in the force curves suggest that a 150-kilodalton putative iron reductase is mobilized within the outer membrane of *S. oneidensis* and specifically interacts with the goethite surface to facilitate the electron transfer process." (Lower et al. 2001: 1360)

"We have shown that under anaerobic conditions, *S. oneidensis* responds to the surface of goethite by rapidly developing stronger adhesion energies at the interface. We interpret these data to indicate that after recognition of goethite as a terminal electron acceptor, *S. oneidensis* actively mobilizes and/or produces proteins (the 150-kD putative reductase and perhaps others) that specifically interact with the mineral surface." (Lower et al. 2001: 1363)

參考文獻清單與連結 (REFERENCE LIST)

Lower, S. K., M. F. Hochella, and T. J. Beveridge. (2001). Bacterial recognition of mineral surfaces: nanoscale interactions between *Shewanella* and α-FeOOH. *Science* 292: 1360-1363. (https://science.sciencemag.org/content/292/5520/1360.full)

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/Shewanella_oneidensis

文章貢獻/編修者與日期:

孔珮珺翻譯 (2019/04/27)；朱天愛編修 (2019/12/19)；吳晧編修 (2020/01/04)；
譚國鎏編修 (2020/05/25)；許秋容編修 (2020/11/26)；紀凱容編修 (2020/11/26)

AskNature 原文連結

https://asknature.org/strategy/bacteria-reduce-iron-oxide/