

# 生物策略表

類別	發明 (Innovation)
生物策略 STRATEGY	受細菌啟發的可再生能源發電機 (Renewable Energy Generator Inspired by Bacteria) 麻省大學阿默斯特分校的空氣動力發電機
生物系統 LIVING SYSTEM	硫還原地桿菌 ( <i>Geobacter sulfurreducens</i> )
功能類別 FUNCTIONS	#獲取、吸收、或過濾能量 #電能轉換 # Capture, Absorb, or Filter Energy # Transform Electrical Energy
作用機制標題	麻省大學阿默斯特分校的氣動發電機使用蛋白質奈米線從天然存在的水蒸氣中產生能量 (Air-powered generator from UMass Amherst generates energy from naturally occurring water vapor using protein nanowires.)
生物系統/作用 機制示意圖 (確認版權、註明出 處；畫質)	 <p><a href="https://asknature.org/wp-content/uploads/2021/03/jake-givens-ocwmWiNAWGs-unsplash-2160x1434.jpg">https://asknature.org/wp-content/uploads/2021/03/jake-givens-ocwmWiNAWGs-unsplash-2160x1434.jpg</a></p>
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
<p>可再生能源發電方法通常依靠某些氣候或天氣模式來產生能源，例如太陽能或風能。可再生能源技術也很難在偏遠地區建造，因為建築需要巨大的成本和多個元件。</p> <p>被稱為 "Air-gen" 的空氣動力發電機含有微生物硫還原地桿菌 (<i>Geobacter sulfurreducens</i>) 可產生的導電蛋白質奈米線 (protein nanowire)。薄膜的底部位於電極上，頂部有一個較小的電極覆蓋奈米線薄膜的一部分。薄膜從大氣中吸附水，電導率和表面化學的組合在兩個電極之間產生電流。Air-gen 不需要陽光或風，甚至可以在室內工作。</p>	

為了獲得能量來生存和生長，一些細菌，如 *Geobacter sulfurreducens*，會製造比人類頭髮薄 10 萬倍的電「電線」。它們將這些奈米線延伸到細胞壁外，並在周圍環境中形成微觀電網。奈米線允許細菌「呼吸」，使用金屬代替氧氣。

### **The Challenge**

Methods of renewable energy generation often rely on certain climate or weather patterns to generate energy, such as solar or wind energy. Renewable energy technology can also be hard to build in remote places due to the large costs and multiple components required for construction.

### **Innovation Details**

The air-powered generator, known as “Air-gen”, contains electrically-conductive protein nanowires produced by the microbe *Geobacter sulfurreducens*. The bottom of the film rests on an electrode, with a smaller electrode covering part of the nanowire film on top. The film adsorbs water from the atmosphere and a combination of electric conductivity and surface chemistry generates a flow of electricity between the two electrodes. Air-gen does not require sunlight or wind, and even works indoors.

### **Biological Model**

To get energy to live and grow, some bacteria such as *Geobacter sulfurreducens* build electrical “wires” 100,000 times thinner than a human hair. They extend these nanowires outside their cell walls and create a microscopic electrical grid in the surrounding environment. The nanowires allow the bacteria to “breathe,” using metals instead of oxygen.

### 文獻引用 (REFERENCES)

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

*Nature* Power generation from ambient humidity using protein nanowires  
(<https://www.nature.com/articles/s41586-020-2010-9>)

#### 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)

#### 撰寫/翻譯/編修者與日期

曾憶慧翻譯 (2022/03/27); 許秋容編修 (2022/06/19)

#### AskNature 原文連結

<https://asknature.org/innovation/renewable-energy-generator-inspired-by-bacteria/>

更多補充的圖片 (1. 確認版權、註明出處 2. 品質: 盡量 72dpi 或 300K)