# 生物策略表

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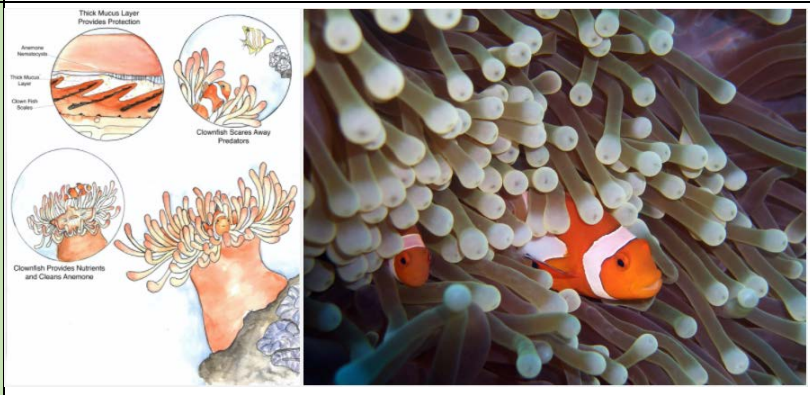
| **類別** | 生物策略 (Strategy) |
| **生物策略**<br>STRATEGY | 錯綜複雜的關係使對方繁盛<br>(Intricate relationship allows the other to flourish) |
| **生物系統**<br>LIVING SYSTEM | 海葵 Actiniaria<br>(Sea anemones) |
| **功能類別**<br>FUNCTIONS | #共同演化 #不同物種之間合作/競爭 #協調維持群落系統<br>#循環養分 #保護免受動物危害 #保護免受微生物危害<br>#Coevolve #Cooperate/compete between different species<br>#Coordinate systems #Cycle nutrients #Protect from animals<br>#Protect from microbes |
| **作用機制標題** | 海葵與小丑魚之間透過共生關係使對方繁盛<br>(The relationship between the sea anemone and clownfish allows the other to flourish through symbiosis.) |
| **生物系統/作用機制示意圖** |  |

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

在海洋中生長著超過 1,000 種海葵，但只有 10 種海葵與 26 種熱帶小丑魚共存 (coexists)。在這些物種中，只有特定組合的海葵跟小丑魚可以共處。牠們的結合是一種義務性互利共生體 (obligatory symbionts)，這代表兩個物種都需要高度依賴對方才能生存。兩個物種之間的共生關係是由多種方式所達成，包括互利保護免受掠食者攻擊、養分的交換，以及小丑魚對海葵刺絲胞 (nematocysts) 的耐受度。

為了與海葵生活在一起，小丑魚最重要的是保護自身免受刺絲胞攻擊。刺絲胞是海葵觸手上魚叉狀的螫刺器，用於捕捉獵物及阻擋掠食者。當大部分魚類嘗試取食營養豐富的觸手，就有可能會被螫到，這也使小丑魚不會啃咬觸手。作為回報，這些海葵也演化成不會攻擊小丑魚。

萬一小丑魚意外受到海葵攻擊時，身上有一層厚重的黏液作為保護。這種黏液層比一般魚類的要厚三到四倍，而且同時含有海葵及小丑魚的黏液。小丑魚在出生時已經有比平均厚的黏液層，隨著牠的成長，牠可以混合自身黏液與海葵的黏液來製造更強大的屏障。

作為提供安全而具保護性住處的回報，小丑魚以數種重要的方式使海葵得益。這些包括清潔海葵、以排泄物的形式提供養分，以及嚇阻例如蝶魚 (butterfly fish)等掠食性魚類。

這篇摘要是由 Allie Miller 所提供。

Of the over 1,000 anemone species that live in the ocean, only 10 species coexists with the 26 species of tropical clownfish. Within these species, only select pairs of anemone and clownfish are compatible. Together, they are obligatory symbionts, which means that each species is highly dependent on the other for survival. Symbiosis between the two species is achieved in a variety of ways including a mutual protection from predators, an exchange of nutrients, and the clownfish's tolerance of anemone nematocysts.

In order to live among the anemone, clownfish first and foremost protect themselves from nematocyst strikes. Nematocysts are harpoon-like stingers on the anemone's tentacles used to capture prey and ward off predators. While most fish try to eat the nutrient-rich tentacles, the possibility of being stung while eating deters the clownfish from nibbling on it. In return, the anemone has evolved to not strike the clownfish.

On the off chance the clownfish is struck, it is protected by a thick mucus layer. The mucus layer is three to four times thicker than other fish, and can be a combination of both anemone and clownfish mucus. The clownfish is born with a mucus layer that is already thicker than average, but as it grows, it can mix its mucus with that of the anemone's to create a stronger barrier.

In return for a safe and protective home, the clownfish benefits the anemone in several important ways. These include cleaning the anemone, providing nutrients in the form of waste, and scaring away predatory fish such as the butterfly fish.

This summary was contributed by Allie Miller.

**文獻引用** (REFERENCES)

「小丑魚 (*Amphiprion clarkii*) 能夠居住在海葵 (*Stichodactyla haddoni*) 的觸手之間而不會受傷害。後者有著強力的螫刺反應，能夠捕捉任何進入觸手之間的非共生魚類。小丑魚的存在影響了海葵的行為，但不影響牠螫刺的能力，推測這並沒有涉及到海葵的神經系統所調控的整體抑制效應。小丑魚對於螫刺的保護作用是依靠其外圍黏液層。這種黏液層比起並非居住在海葵中的魚類要厚三到四倍，並由大量含有中性多醣的醣蛋白所組成。小丑魚的黏液在曝露於極端變性環境後仍保持惰性 (inert)，推測黏液當中並不含化學遮蔽性的特定刺絲胞抑制劑或刺激性物質；它的惰性特質可能是由於缺乏那些存在於非共生魚類黏液中的刺激性化合物。」(Lubbock et al. 1980: 35)

"The clownfish *Amphiprion clarkii* is able to live unharmed amongst the tentacles of the sea anemone *Stichodactyla haddoni*. The latter has a powerful stinging response and would be capable of capturing any non-symbiotic fish that entered the tentacles. The presence of clownfish affects the anemone's behaviour but does not impair its stinging ability, suggesting that a general inhibitory effect mediated by the anemone's nervous system is not involved. *A. clarkii* achieves protection from stinging by means of its external mucus layer. This layer appears to be three to four times thicker than that of related fishes that do not inhabit anemones and consists largely of glycoprotein containing neutral polysaccharide. The mucus of *A. clarkii* remains inert after exposure to extreme denaturing conditions, suggesting that it does not contain specific nematocyte inhibitors or excitatory substances that are masked chemically; its inert nature probably results from a lack of those stimulatory compounds that are present in the mucus of non-symbiotic fishes." (Lubbock et al. 1980: 35)

**參考文獻清單與連結** (REFERENCE LIST)

Lubbock, R. (1980). Why are clownfishes not stung by sea anemones?. *Proc. R. Soc. Lond. B* 207: 35-61. (https://doi.org/10.1098/rspb.1980.0013)

**延伸閱讀**

AskNature Team. (27 October, 2016). Mucus coat protects from sea anemone. *AskNature*. Retrieved from: https://asknature.org/strategy/mucus-coat-protects-from-sea-anemone/#.U-KEYPldWSq

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

https://en.wikipedia.org/wiki/actiniaria
https://www.onezoom.org/life/@actiniaria
https://eol.org/pages/1747

**撰寫/翻譯/編修者與日期**

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**AskNature 原文連結**

https://asknature.org/strategy/intricate-relationship-allows-the-other-to-flourish/