生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	生活在突尼西亞的沙漠螞蟻如何將嗅覺立體化 (How Tunsian Desert Ants Smell in Stereo)
生物系統 LIVING SYSTEM	長腳沙漠螞蟻 *Cataglyphis fortis*
功能類別 FUNCTIONS	#從環境感應光線 (可見光) #從環境感應化學訊號 (氣味、品味等) #在陸地上導航 # Sense Light (Visible Spectrum) From the Environment # Sense Chemicals (Odor, Taste, etc.) From the Environment # Navigate Over Land
作用機制標題	在突尼西亞的沙漠螞蟻會利用觸角探測左右通道中的氣味，以建構詳細的嗅覺地圖 (The antennae of the Tunisian desert ant create a detailed olfactory map by detecting smells in left and right channels)
生物系統/作用機制示意圖 (確認版權、註明出處；畫質)	

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

一種生活在突尼西亞的沙漠螞蟻，*Cataglyphis fortis* 長途跋涉穿越該國的鹽田尋找食物。螞蟻回到巢穴需利用視覺和以嗅覺為依據的地標，以定位它們的巢穴入口。沙漠螞蟻通過記住巢穴入口周圍的氣味知道它找到回家的路，而且它的一對觸角作為它的歸巢裝置。

在一次覓食之旅後，此沙漠螞蟻需要額外的幫助，才能找到返回巢穴的路；因為它會在距離巢穴 100 多公尺處（328 英尺）尋找食物。雖然視覺標誌可能有助於將螞蟻引回巢穴入口附近，但沒有氣味標記，入口本身並不顯眼。除了視覺標誌之外，這些螞蟻還使用路徑整合，這是一種追蹤螞蟻行進方向和距離的心理地圖，並協助螞蟻估計其從當前位置回到起點所經路徑。這張地圖被認為是螞蟻為了找到回家的路而要遵循的一系列路徑，即使沒有任何地標或參考點，在螞蟻外出覓食時，地圖會不斷更新。

路徑整合不一定是最快的回家方式，因為它不牽涉探索更有效的路線，但它是可靠的。也許比路徑整合更令人著迷的是螞蟻所分泌及記住的氣味地圖。在螞蟻上次覓食後返回的旅程中，螞蟻是以氣味是來自左、右側為依據而記住。實驗證明，缺失一根觸角的螞蟻，無法按照他們的氣味地圖回家。這意味著一對觸角是一起工作，以準確定位出氣味的來源，就像分開的左右聲道揚聲器如何讓我們更準確的判定聲音的來源。

嗅覺檢測在歸航設備中很有用，例如可能無法使用其他導航線索的自動駕駛或遠程操作的車輛。除了使用視覺標誌外，將建立和記住嗅覺地圖的能力構建到歸航設備中，能提高其尋找和搜尋目標的效率。路徑整合提供了一種導航模型。這對於地圖上未被繪製和潛在動態環境（如殘骸和瓦礫）的救援設備特別重要。

A species of desert ant in Tunisia, Cataglyphis fortis, travels long distances through the country's saltpans in search of food. Returning ants orient themselves to their nest entrance using both visual and scent-based landmarks.

A desert ant knows it has found its way back home by remembering the scent around its nest entrance, with its two antennae acting as its homing device. This desert ant needs the extra help to find its way back to its nest after a foraging trip because it can travel more than 100 meters (328 feet) away from its nest in search of food. While visual landmarks may be useful in directing an ant back toward the general vicinity of its nest entrance, the entrance itself is inconspicuous without its scent marker. In addition to visual landmarks, these ants use path integration, which is a mental map that tracks the direction and distance of the ant's travels, and results in an estimate of the path the ant needs to take to get back to its starting point from its current location. This map can be thought of as a series of paths an ant knows to follow to find its way back home—even without any landmarks or points of reference—and they are constantly being updated while an ant is out foraging.

Path integration is not always the fastest way to get home since it doesn't involve exploring more efficient routes, but it is reliable. Perhaps even more fascinating than path integration is the map of smells the ants create and commit to memory. Odors are memorized according to whether they come from the left or the right of the ant throughout its previous return journeys from foraging. It has been experimentally proven that ants lacking use of one of their antennae are incapable of following their map of smells to return home. This means that the antennae are working together to pinpoint the source of a scent, much like how separate left- and right-channel speakers allow us to better determine the apparent source of a sound.

Olfactory detection could be useful in homing devices, such as those in self-driving vehicles or vehicles that are operated remotely and which might lose access to other navigational cues. Building the ability to create and remember olfactory maps into homing devices, in addition to their use of visual landmarks, would improve their effectiveness and efficiency in finding targets. Path integration offers a model for navigation. This could be particularly significant for rescue devices searching through unmapped and potentially dynamic environments such as wreckage and rubble.

文獻引用 (REFERENCES)

“螞蟻會記住嗅覺地形，也就是說，在螞蟻回家的途中，會定位哪些氣味來自於其右側或左側。” （Steck 等人 2010:943）

“單方面切除觸角的螞蟻無法在二維陣列中精確定位巢穴。因此，這種定向取決於一對觸角的同時作用，即立體嗅覺。” （Steck 等人 2010:939）

“The ants memorize the olfactory topography, that is, which odours are positioned on the right or the left side during the ants’ home-bound runs.” (Steck et al. 2010:943)

“Unilaterally antennectomized ants could not pinpoint the nest within a two-dimensional array. Hence, this kind of orientation depends on the simultaneous input of both antennae, that is, on a stereo sense of smell.” (Steck et al. 2010:939)

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

Do desert ants smell the scenery in stereo?

Animal Behaviour | 2010 | Kathrin Steck, Markus Knaden & Bill S. Hansson

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

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AskNature 原文連結

https://asknature.org/strategy/the-tunsian-desert-ants-antennae-detect-environmental-smells-from-left-and-right/

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