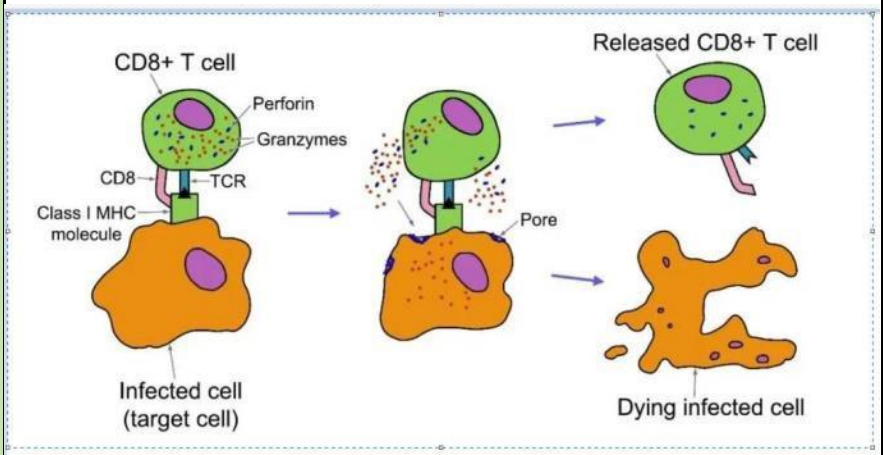
生物策略表

類別	生物策略 (Strategy)
生物策略 Strategy	免疫系統如何辨別真正的威脅 How Immune Systems Identify Real Threats
生物系統 Living system	Animals 動物
功能類別 FUNCTIONS	#保護免受微生物傷害 #Protect From Microbes
作用機制標題	免疫系統不斷監測威脅，但在出現細胞死亡跡象時會做出有效反應。(Immune systems constantly monitor threats, but respond in force when there are signs of cell death.)
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)

Introduction

很容易您會認為的免疫系統通常不活躍，等待發生重大感染時開始發揮作用，但實際上它從未停止過。 每天，免疫系統都在評估外來顆粒的危險：花粉、吸入的地毯碎片、接觸表面上的無害細菌，以及不常見的潛在危險微生物。

免疫系統反應在能量方面是昂貴的，雖然它們至關重要，但它們也會對身體造成傷害。 這些反應和過度反應對宿主來說可能從不舒服到危險。 免疫系統應該對哪些粒子做出反應，應該忽略哪些粒子？ 得到正確的答案實際上是生死攸關的問題。

會對我們的身體構成威脅的微生物和化學物質具有無害的微生物和化學物質所沒有的特徵：它們會導致細胞死亡。當一個細胞因攻擊而死亡時，該細胞的內容物會被釋出，流入其他細胞之間的液體中。這些分子通常存在於細胞及其衍生物中，這些分子有一個新的用途：它們可以作為信號，觸發構成我們免疫系統的仍然健康的細胞反應。透過這種方式，免疫系統可以區分危險和非危險微生物，並最大限度地減少對實際上沒有威脅的外來顆粒的過度反應。

例如，當病原微生物傷害和破壞哺乳動物體內的細胞時，這些細胞中的遺傳物質（RNA 和DNA）開始分解。遺傳物質含有大量稱為嘌呤的分子。嘌呤從基因中釋放出來、失去一個電子（氧化）形成一種新的化合物，尿酸。因此，感染而死亡的細胞會在感染過程中產生大量的尿酸，而這些物質會流入細胞外基質。上述過程形成了連鎖反應，其中尿酸刺激樹突狀細胞變得更多和更活躍。這些活化的樹突狀細胞隨後會傳播到淋巴結，在那裡它們會提醒免疫細胞（例如 T 細胞）正在發生感染。然後 T 細胞前往感染部位攻擊病原微生物。

對無害外來顆粒的免疫反應會使身體保持近乎恆定的免疫活動狀態，消耗不必要的能量， 並且更容易患上自身免疫性疾病。“死細胞警報”過程有助於確保免疫系統不會僅僅因為外來顆粒的存在而變得活躍。外來物質和細胞死亡的證據都需要觸發免疫反應。

It can be easy to think of your immune system as generally inactive, waiting to spring into action when a major infection comes on, but it is in fact never at rest. Daily, the immune system is assessing the danger of foreign particles: flower pollen, carpet bits you inhale, harmless bacteria on surfaces you touch, and, not infrequently, potentially dangerous microbes.

Immune system responses are costly in terms of energy and while they are of critical importance, they also take a toll on the body. These reactions and overreactions can range from uncomfortable to even dangerous for the host. Which particles should an immune system react to, and which should it ignore? Getting the answer right is literally a matter of life and death.

Microbes and chemicals that are a threat to our bodies share a feature that harmless ones do not: they cause cell death. When a cell dies due to an attack, the contents of that cell pour out, flowing into the fluids between other cells. Some of these molecules normally found inside cells and their derivatives (衍生物) then serve a new purpose: they can function as signals, triggering a response from the still healthy cells that comprise our immune system. In this way, an immune
system can distinguish between dangerous and non-dangerous microbes, and minimize overreacting to foreign particles that actually are no threat.
For example, as pathogenic microbes injure and destroy cells inside a mammal, the genetic material in these cells (RNA and DNA) begins to fall apart. Genetic material contains large amounts of a molecule called purine (嘌呤). Liberated from genes, purine loses an electron (oxidizes) to form a new compound, uric acid. Thus, during

infection, large amounts of uric acid are produced by cells dying from infection, and that acid pours into the extracellular matrix.

This sets off a chain reaction in which the uric acid stimulates dendritic cells (樹突細胞) to become more numerous and more active. These activated dendritic cells then travel to lymph nodes (淋巴結) where they alert immune cells such as T cells (T 細胞) that an infection is underway. The T cells then travel to the infection site to attack the pathogenic microbe.

An immune response to harmless foreign particles would keep the body in a near-constant state of immune activity, use unnecessary energy, and be more susceptible to autoimmune disorders. The “dead cell alert” process helps ensure that the immune system doesn’t become active simply due to the presence of a foreign particle. Foreign matter and evidence of cell death are both needed to trigger an immune response.

文獻引用 (REFERENCES)

在感染中，微生物成分會提供警報信號，這會使免疫系統對危險和促進產生免疫。在沒有此類信號的情況下，通常沒有可能會產生免疫反應或耐受性。這導致了免疫系統只對抗原有反應的概念被認為與危險情況有關，例如感染。危險信號被認為是通過刺激來使起作用的樹突狀細胞成熟，以便它們可以呈遞外來抗原並刺激T 淋巴細胞。瀕死的哺乳動物細胞還被發現釋放身份不明的危險信號。
在這裡，我們表明尿酸是主要的內源性危險受損細胞釋放的信號。尿酸刺激樹突細胞成熟，並且當在體內與抗原共同注射時，顯著增強來自CD81 T 細胞的生成反應。

In infections, microbial components provide signals that alert the immune system to danger and promote the generation of immunity. In the absence of such signals, there is often no immune response or tolerance may develop. This has led to the concept that the immune system responds only to antigens perceived to be associated with a dangerous situation such as infection. Danger signals are thought to act by stimulating dendritic cells to mature so that they can present foreign antigens and stimulate T lymphocytes. Dying mammalian cells have also been found to release danger signals of unknown identity.
Here we show that uric acid is a principal endogenous danger signal released from injured cells. Uric acid stimulates dendritic cell maturation and, when co-injected with antigen in vivo, significantly enhances the generation of responses from CD81.

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

Molecular identification of a danger signal that alerts the immune system to dying cells.

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

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https://asknature.org/strategy/how-immune-systems-identify-real-threats/