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生物学Biology

Homing pigeon navigation relies on superparamagnetic macrophages under overcast conditions

阴天条件下，信鸽的导航依赖超顺磁性巨噬细胞

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链接：

<https://www.science.org/doi/10.1126/science.ady2486>

摘要：

鸟类使用多种导航策略，包括地磁场，尤其是在其他线索不可用时（例如阴天或夜间条件下）。有人提出喙中的磁铁矿颗粒、眼中的隐花色素、细胞离子通道的改变以及前庭系统的变化来解释磁感受，但确切的机制仍存在争议。研究者通过物理、形态学、功能性和基因组学分析，鉴定了肝脏中超顺磁性巨噬细胞的存在。

他们发现，在巨噬细胞耗竭后，阴天条件下飞行的鸽子丧失了其通常的方向定位能力。而在晴天可见太阳时，巨噬细胞耗竭的鸽子方向定位能力未受影响，这表明太阳是其主要的定位线索。他们提出，在原鸽的归巢行为中，肝脏中的超顺磁性巨噬细胞是找到地磁方向所必需的。

Abstract：

Birds use a variety of navigational strategies, including the geomagnetic field, especially when other cues are not available, such as under overcast or nocturnal conditions. Magnetite particles in the beak, cryptochromes in the eye, cellular ion-channel alterations, and changes in the vestibular system have been proposed to explain magnetoreception, but the exact mechanisms remain debated. Here, we used physical, morphological, functional, and genomic assays to identify the presence of superparamagnetic macrophages in the liver. We found that after macrophage depletion, pigeons flying under overcast conditions lacked their usual orientation capabilities. Orientation was unimpaired in birds without macrophages when the sun was visible, suggesting that this was their primary cue. We propose that in homing pigeons, superparamagnetic macrophages in the liver are required for finding magnetic direction.

医学Medicine

Visualizing a lung neutrophil-platelet immunothrombosis cascade during sepsis in mice

可视化小鼠败血症期间肺部中性粒细胞—血小板免疫血栓级联反应

作者：LUKE BROWN, JARED SCHLECHTE, MAHUM RASHID, YUEFEI LOU, ANGELA P. NGUYEN, MORTAZA F. HASSANABAD, CARLOS H. HIROKI, EDUARDO COBO, MORLEY D. HOLLENBERG, AND BRYAN G. YIPP, etc.

链接：

<https://www.science.org/doi/10.1126/science.adv0377>

摘要：

败血症是一种危及生命的疾病，由感染引发过度、失调的免疫反应所致。研究者利用小鼠活体成像获得的信息，揭示了血液细菌感染后肺部血管内血栓形成的逐步过程。

中性粒细胞与血小板之间的聚集体最初有助于抗菌反应，但随后在趋化因子白三烯B4的依赖性步骤中发展为有害的血栓。在感染前通过基因敲除或使用白三烯抑制剂齐留通阻断这一信号，可保护小鼠免受败血症的影响。

Abstract：

Sepsis is a life-threatening condition initiated by an infection that triggers an overwhelming, dysregulated immune response. Brown et al. used information derived from live imaging of mice to understand the events leading to the formation of clots in the lung vasculature after bacterial infection of the bloodstream.

Aggregates between neutrophils and platelets initially contributed to antibacterial responses but developed into detrimental thrombi in steps dependent on the chemoattractant leukotriene B4. Blocking this signal through genetic deletion or treatment with the leukotriene inhibitor zileuton before infection protected mice from sepsis.

A high-throughput selection system for fast-acting covalent protein drugs

一种用于快速共价蛋白药物筛选的高通量筛选系统

作者：QIONGXUAN FAN, JIAHAO MEI, TIAN LI, CHUANLONG ZANG, MENGJIAO LI, JING TANG, YOU XU, GE YU, DANDAN LIU, AND BOBO DANG, etc.

链接：

<https://www.science.org/doi/10.1126/science.adv3081>

摘要：

共价连接可以将那些原本会被机体迅速清除的蛋白质转化为强效且高度选择性的细胞信号通路调节剂。然而，体内的交联速率通常非常缓慢。研究者开发了一种高通量酵母展示系统，用于设计共价蛋白，以提高其与目标配体的交联速率。

他们通过开发一种针对癌症免疫治疗靶点——程序性死亡配体-1 (PD-L1) 的快速作用纳米抗体，展示了该方法的可行性。与目前使用的纳米抗体相比，该纳米抗体在抑制肿瘤生长方面表现出更好的效果。他们还设计了一种共价细胞因子和一种针对病毒受体结合域的中和结合剂。该平台可能为一系列共价蛋白药物的应用提供快速且通用的蛋白质工程改造手段。

Abstract：

Covalent linkages can transform proteins that would otherwise be quickly cleared from the body into potent and highly selective modulators of cellular signaling pathways. However, cross-linking rates in vivo are generally very slow. Fan et al. developed a high-throughput yeast display system to engineer covalent proteins to enhance the cross-linking rate to their target ligand. They demonstrated the approach by developing a fast-acting nanobody against the cancer immunotherapy target programmed death-ligand 1, which showed promising reductions in tumor growth relative to currently used nanobodies. They also engineered a covalent cytokine and a neutralizing binder for a viral receptor-binding domain. This platform may enable rapid and versatile protein engineering for a range of covalent protein drug applications.

地震学Seismology

Upper-mantle earthquakes beneath East Antarctica

东南极洲下方的上地幔地震

作者：LONG M. HO, JOSÉ L. SÁNCHEZ-ROLDÁN, SAMANTHA E. HANSEN, AND JACOB I. WALTER

链接：

<https://www.science.org/doi/10.1126/science.aea9895>

摘要：

板内中源地震（IDEs）发生在深度超过 70 公里的区域，远低于地壳的脆—韧性转变深度，其成因难以用传统板块构造理论解释。研究者将深度学习技术应用于区域地震数据，识别出南极洲下方的板内中源地震。这些地震的发生可以用东南极洲边缘（该处岩石圈强度发生突变）因热驱动差异抬升所产生的集中弯曲应力来解释。

研究结果支持了地球动力学模型的预测，即板内地震活动性强烈依赖于岩石圈—软流圈的相互作用。南极冰盖也会影响区域应力状态，凸显了地球各系统之间复杂的相互作用。先进的地震探测能力（如本文所使用的技术）可能揭示出，板内中源地震在全球范围内比目前认识到的更为普遍。

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Abstract：

Intraplate intermediate-depth earthquakes (IDEs) occur at depths >70 kilometers, which is well below the brittle-ductile transition in Earth's crust, and their origins are difficult to reconcile with traditional plate tectonics. We applied a deep-learning technique to regional seismic data and identified intraplate IDEs beneath Antarctica. Their occurrence can be explained by concentrated bending stresses resulting from variable, thermally driven uplift along the edge of East Antarctica, where there is an abrupt change in lithospheric strength. Our results support geodynamic model predictions that intraplate seismicity strongly depends on lithosphere-asthenosphere interactions. The Antarctic ice sheet can also affect regional stress conditions, highlighting the complex interplay between Earth systems. Advanced seismic detection

capabilities, such as those used here, could reveal that intraplate IDEs are more common globally than currently recognized.

Stopping phase reveals abrupt arrest of large strike-slip earthquakes

停止相揭示大型走滑地震的突然止裂

作者：JESSE KEARSE AND YOSHIHIRO KANEKO

链接：

<https://www.science.org/doi/10.1126/science.aef3733>

摘要：

地震震级受控于破裂传播在何处、何时停止。然而，在天然地震的近场地震记录中，破裂止裂现象很少被直接观测到。研究者展示了大型走滑地震中地面运动停止相的系统性近场观测结果。对全球12次地震事件的分析表明，平行断层方向的地表位移中的瞬态过冲是破裂传播突然终止的可靠诊断标志。

动态破裂模拟显示，浅层低波速岩石会强烈放大近场地动信号，从而增强地表记录到的位移过冲幅度。停止相出现在远离已知破裂末端的近断层位置，这意味着大型走滑地震以分段方式破裂，动态破裂传播在内部断层段边界处会被突然中止并重新启动。

Abstract：

Earthquake magnitude is controlled by where and when rupture propagation stops. However, rupture arrest has rarely been directly observed in near-field seismic records of natural earthquakes. Here, we present systematic near-field observations of ground-motion stopping phases from large strike-slip earthquakes. Analysis of 12 global events shows that transient overshoot in fault-parallel ground surface displacement is a robust diagnostic signature of abrupt termination of rupture propagation. Dynamic rupture simulations reveal that near-field ground motions are strongly amplified by low-wavespeed rocks at shallow depth, which enhances the amplitude of displacement overshoot recorded at the surface. The occurrence of stopping phases at near-fault locations far from mapped rupture termini implies that large strike-slip earthquakes rupture in a segmented manner, with dynamic rupture propagation punctuated by abrupt arrest and reinitiation at internal fault-segment boundaries.

生态学Ecology

Importance of elephants for dung beetle biodiversity and ecosystem functions

大象对粪金龟生物多样性和生态系统功能的重要性

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链接：

<https://www.science.org/doi/10.1126/science.aeb7062>

摘要：

大型哺乳动物食草动物在生态系统中发挥着关键作用，且极易因捕猎和全球环境变化而灭绝。人们预计，这类物种的丧失将引发进一步的物种灭绝，但这一模式此前主要通过模拟研究来证明。

研究者将模拟与实验证据相结合，表明大象的消失会导致粪金龟的共灭绝，并降低粪金龟所提供的粪便分解和二次种子传播功能。在野外，排除大象会显著降低粪金龟的丰度和多样性，而排除其他哺乳动物食草动物则几乎没有额外影响。这些结果与大象在经验推导的生态网络中的核心地位相符，并支持将大象认定为非洲稀树草原的关键种。

Abstract：

Large mammalian herbivores play key roles in ecosystems and are vulnerable to extinction from hunting and global environmental change. Loss of such species is expected to cause further extinctions, but this pattern has mainly been shown through simulations. Gijssman et al. combined simulations with experimental evidence to show that loss of elephants would lead to coextinctions of dung beetles and decreases in the dung decomposition and secondary seed dispersal that beetles provide. In the field, excluding elephants reduced dung beetle abundance and diversity, whereas excluding other mammalian herbivores had little additional effect. These results aligned with the central role of elephants in an empirically derived ecological network and support the designation of elephants as a keystone species in African savannas.

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