《自然》（20260514出版）一周论文导读

作者：writer 来源：科学网

本文原地址：https://www.iikx.com/news/progress/39837.html

《自然》（20260514出版）一周论文导读。

Nature, 14 May 2026, Volume 653 Issue 8114

《自然》2026年5月14日，第653卷，8114期

Two-qubit logic and teleportation with mobile spin qubits in silicon

硅基移动自旋量子比特的双量子比特逻辑与传送

▲ 作者：Y. Matsumoto, M. De Smet et al.

▲链接：

https://www.nature.com/articles/s41586-026-10423-9

▲摘要：

研究者报道了在半导体器件中，通过独立移动的势能极小值将两个电子自旋相对输运，并演示了它们之间的双量子比特操作。研究者发现，相互作用强度可通过两个自旋的空间间距进行高度调控。当两个自旋各向中心输运120纳米（总位移240纳米）时，双量子比特门平均保真度达到约99%。

此外，研究者实现了相距320纳米的量子比特之间的条件后选择量子态传送（传输保真度为87%），展示了移动自旋量子比特在非局域量子信息处理中的潜力。研究者预计，对可移动量子比特的操作将成为未来大规模半导体量子处理器的通用特征。

▲ Abstract：

Here we demonstrate two-qubit operations between two electron spins carried towards each other in separate travelling potential minima in a semiconductor device. We find that the interaction strength is highly tunable by their spatial separation. When we shuttle the two spins towards the centre by 120?nm each for a total displacement of 240?nm, we achieve an average two-qubit gate fidelity of about 99%. Furthermore, we implement conditional post-selected quantum state teleportation between qubits separated by 320?nm with an average gate fidelity of 87%, showcasing the potential of mobile spin qubits for non-local quantum information processing. We expect that operations on mobile qubits will become a universal feature of future large-scale semiconductor quantum processors.

生物学Biology

Asymmetric splitting in dividing lipid-nucleotide multilamellar droplets

脂质—核苷酸多层液滴分裂中的不对称分裂

▲ 作者：He Meng, Liyan Jia et al.

▲链接：

https://www.nature.com/articles/s41586-026-10489-5

▲摘要：

研究者展示了在缺乏重构蛋白质机器的情况下，结构化液滴仍能表现出不对称分裂。在碱性磷酸酶或多价金属阳离子存在下，单个多层液滴分裂产生两个形态各异的子代结构（液滴与囊泡）。

研究者发现，这种异形分裂是由单个表面小窝沿潜在核—壳域边界周向生长所驱动的，其机制源于脂质头基—核苷酸抗衡离子相互作用的诱导变化。同时，研究者证明了功能性生物分子能在不同原始细胞世代之间实现转移。综上，研究结果为自下而上组装可增殖的人工细胞迈出了一步。

▲ Abstract：

Here we show that structured liquid droplets exhibit asymmetric division in the absence of reconstituted protein machinery. In the presence of alkaline phosphatase or multivalent metal cations, individual multilamellar droplets split to produce two morphologically distinct progeny (droplet and vesicle). We show that heteromorphic division occurs by circumferential growth of a single surface caveola along a latent core – shell domain boundary because of induced changes in lipid headgroup – nucleotide counterion interactions and demonstrate that functional biomolecules are transferred between the different protocell generations. Taken together, our results provide a step towards the bottom-up assembly of proliferating artificial cells.

地球科学Earth Science

More concentrated precipitation decreases terrestrial water storage

更集中的降水减少了陆地水储量

▲ 作者：Corey S. Lesk Justin S. Mankin

▲链接：

https://www.nature.com/articles/s41586-026-10487-7

▲摘要：

研究者表明，更集中的降水会减少全球各气候区的陆地水分可用性，其干燥效应强度与总降水量增加带来的湿润效应相当。理想化模拟表明，这一现象源于地表水文再分配变化导致的蒸发增强，简单与复杂的地表模型均能复现这一观测效应。

在全球变暖约2°C的情景下，由升温驱动的降水集中化对陆地水储量的预估影响将导致全球27%人口所处的陆地表面转为异常干燥状态（≥0.5个标准差），且这一效应独立于总降水量或灌溉量的变化。这项研究揭示了陆地水平衡新的关键决定因素，强调了其对降水时间分布的敏感性，对未来水资源可用性具有深远影响。

▲ Abstract：

Here we show observationally that more concentrated precipitation decreases land water availability across

all climates globally, a drying effect as strong in magnitude as the wetting effect of increased total precipitation. Simple and complex land-surface models recover the observed effect, whereas idealized simulations show that it arises from enhanced evaporation caused by hydrologic partitioning changes at the land surface. Projected terrestrial water storage impacts of warming-driven precipitation concentration at about 2? ° C of warming shift the land surface to abnormally dry conditions (≥0.5 standard deviation10) for 27% of the global population, independent of any total precipitation or irrigation changes. Our results show new key determinants of the land water balance, highlighting its sensitivity to the temporal distribution of precipitation, with broad implications for future water availability.

Higher-order interactions enhance the latitudinal tree diversity gradient

高阶相互作用增强了树木的物种纬度多样性梯度

▲ 作者：Yuanzhi Li (李远智), Junli Xiao (肖俊丽) et al.

▲链接：

https://www.nature.com/articles/s41586-026-10434-6

▲摘要：

跨越32个大型永久森林样地（多数位于北半球），研究者同时检验了树木生长与存活中的成对相互作用和高阶相互作用。在1543个物种—样地组合（针对树木生长）中，40%检测到高阶相互作用存在的证据；在1340个类似组合（针对树木存活）中，该比例为23%，且这些相互作用的强度随纬度升高而减弱。

研究者发现，高阶相互作用有利于稀有物种，而不利于常见物种，揭示了其促进物种多样性的潜在机制。这种稳定效应随纬度升高而减弱，与树种纬度多样性梯度相吻合。这一研究结果揭示了成对相互作用与高阶相互作用在促进树种纬度多样性梯度形成中的重要协同作用，并有助于阐明负密度制约效应对这一生物地理格局的贡献。

▲ Abstract：

Here we examined both pairwise interactions and HOIs across 32 large permanent forest plots, most in the northern hemisphere. We detected evidence of HOIs in 40% of the 1,543 species – plot combinations for tree growth, and 23% of the 1,340 such combinations for tree survival, with the strength of these interactions declining with latitude. HOIs were found to benefit rare species but disadvantage common species, suggesting a potential mechanism promoting species diversity. This stabilizing effect weakened towards higher latitudes, consistent with the latitudinal tree diversity gradient. Our findings reveal an important interplay between pairwise interactions and HOIs in promoting the latitudinal tree diversity gradient and help to clarify the contribution of CNDD to this biogeographic pattern.

古生物学Chemistry

Oxygen supply through the tracheolar – muscle system does not constrain insect gigantism

通过气管—肌肉系统供氧不会限制昆虫的巨大化

▲ 作者：Edward P. Snelling, Antonia V. Lensink et al.

▲链接：

https://www.nature.com/articles/s41586-026-10291-3

▲摘要：

研究者对假说提出质疑，通过分析昆虫飞行肌中微气管占据的相对空间，得出以下结论：（1）在跨越一万倍体重范围（涵盖10目44个物种的1320张显微图像）内，该相对空间仅增加1.8倍；（2）大多数物种中该比例通常为1%或更低；（3）当关系外推至已灭绝的巨大蜻蜓近缘物种Meganeuropsis permiana（约100克）时，上述观测结果依然成立。

尽管存在明确的进化潜力，但微气管投资随体型增长并未显著增强，且其空间需求极小，这些证据充分说明：通过气管—肌肉系统的扩散性供氧并不限制现存或史前巨型昆虫的最大体型。

▲ Abstract：

Here we contest this hypothesis by showing that the relative space occupied by tracheoles in the flight muscle of insects (1) increases by only 1.8-fold over a 10,000-fold body mass range (1,320 micrographs, 44 species, 10 orders), (2) is typically 1% or less in most species, and (3) that this observation holds when we extend our relationship to the long-extinct gigantic dragonfly-like Meganeuropsis permiana (approximately 100?g). The small space requirement and the lack of a strong increase in tracheolar investment with body size, despite clear evolutionary potential to do so, provide convincing evidence that diffusive oxygen transport through the tracheolar – muscle system does not constrain the maximum body size of extant or gigantic prehistoric insects.

医学Medicine

Evolution of pandemic cholera at its global source

全球源头大流行性霍乱的演化

▲ 作者：Amber Barton, Mokibul Hassan Afrad et al.

▲链接：

https://www.nature.com/articles/s41586-026-10340-x

▲摘要：

研究者表明，尽管孟加拉国与印度存在霍乱弧菌传播事件，但过去20年间两国菌株总体上呈独立演化态势，其分化显然受国界而非恒河三角洲及盆地等水文特征制约。孟加拉国境内的演化模式与印度明显不同，表现为基因及可移动遗传元件（尤其是噬菌体防御相关元件）的快速获得与丢失。这些防御系统的缺失与重症风险增加及向孟加拉国境外传播相关。

2018年孟加拉国发生的谱系更替导致噬菌体防御系统发生重大变化，同时伴随裂解性噬菌体ICP1的谱系及抗防御系统的快速变迁。这项研究表明，跨越孟加拉国与印度北部的恒河流域（而非恒河三角洲）很可能是全球大流行病的源头。这一发现修正了孟加拉国作为全球霍乱源头的传统认知，并凸显了噬菌体在当前第七次大流行中控制谱系传播的潜在作用。

▲ Abstract：

Here we show that, although transmission events occur between Bangladesh and India, V.?cholerae in the two countries has largely evolved separately over the past 20?years, apparently constrained by national borders rather than by hydrological features, such as the Ganges Delta and Basin. Evolution within Bangladesh was distinct from that seen in India, involving rapid gain and loss of genes and mobile genetic elements, particularly those involved in phage defence. The loss of these systems was associated with increased risk of severe disease and transmission outside Bangladesh. Lineage replacement in Bangladesh in 2018, resulting in a major change in phage defence systems, was accompanied by a rapid change in the lineage and anti-defence system of lytic phage ICP1. Here we show that the Ganges Basin, falling across Bangladesh and Northern India, rather than the Ganges Delta, probably acts as a global launch pad for pandemic disease. This shifts our understanding of Bangladesh as the purported global source of cholera and underscores the potential role of phage in controlling spread of lineages within the current seventh pandemic.

作者：李言 来源：科学网微信公众号