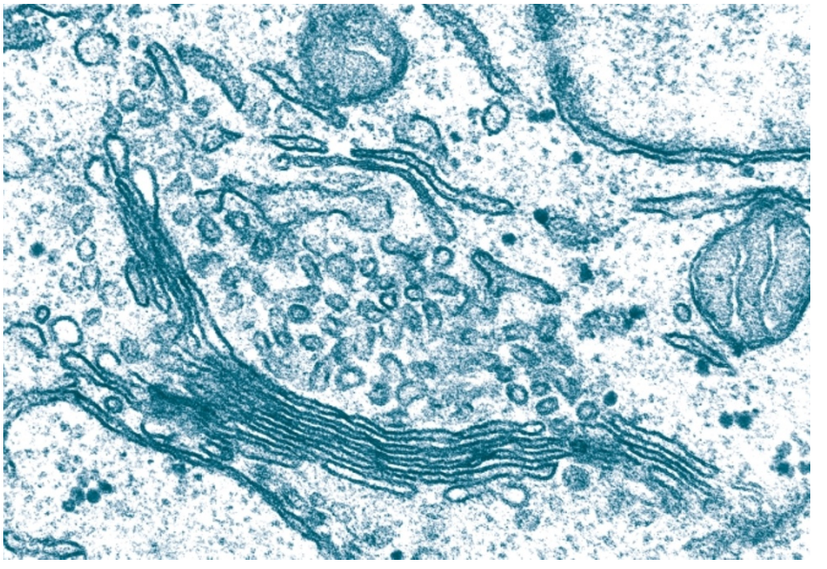
HIGHLIGHTS

MEMBRANE DYNAMICS

Independence day



Virtually every aspect of Golgi biology is surrounded by some controversy, and they all boil down to one basic question: is the Golgi subordinate to the endoplasmic reticulum or is it an independent organelle? Graham Warren and colleagues have now found some ingenious ways to show that the Golgi is an independent organelle.

Why should we think that the Golgi depends on the ER in the first place? Under conditions in which ER-to-Golgi transport is blocked, the Golgi stack completely disappears and Golgi enzymes end up in the ER. This means that Golgi enzymes cycle constitutively between the two organelles, and raises the possibility that the Golgi could be a transient structure.

If Golgi biogenesis and function depend on the ER, one prediction is that it should be possible to recreate a functional Golgi from the ER. Pelletier *et al.* report in *Nature Cell Biology* that this is not the case. They used microsurgery to create Golgi-free cell pieces that contain parts of the ER. In these cell pieces, newly synthesized proteins could be transported out of the ER, but they did not make it to the plasma membrane.

In a parallel study published in *Nature*, Seemann *et al.* tested whether the ER is necessary to form a Golgi structure, and found that it's not. They first treated cells with the fungal metabolite brefeldin A, which fragments the Golgi stack and sends Golgi enzymes back to the ER. This is a reversible process, and removing brefeldin A leads to the reformation of a functional Golgi. But while washing out brefeldin A, the authors injected the cells with a dominant-negative construct of a small GTPase, which inhibits exit from the ER. Despite the absence of traffic from the ER to the Golgi, structures were formed that resembled a Golgi, were properly localized in the cell and contained some Golgi matrix proteins. But they were devoid of oligosaccharide-modifying Golgi enzymes, which remained stuck in the ER.

So the ER seems to be neither sufficient nor necessary for Golgi structure and function. The picture that emerges is that the Golgi is an independent organelle containing recycling enzymes as well as resident matrix proteins. The resident proteins have all the necessary information for Golgi structure and location, and form a scaffold around which the Golgi enzymes assemble to modify cargo in transit. Will this new view of the Golgi survive the test of time?

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References and links

ORIGINAL RESEARCH PAPER Pelletier, L., Jokitalo, E. & Warren, G. The effect of Golgi depletion on exocytic transport. *Nature Cell Biol.* **2**, 840–845 (2000) | Seemann, J., Jokitalo, E., Pypaert, M. & Warren, G. Matrix proteins can generate the higher order architecture of the Golgi apparatus. *Nature* **407**, 1022–1026 (2000)
FURTHER READING Pelham, H. R. B. & Rothman, J. E. The debate about transport in the Golgi — two sides of the same coin? *Cell* **102**, 713–719 (2000)
WEB SITE Graham Warren's laboratory