Journal club

ESCRTs: THE FINAL CUT FOR CELLS

How a cell is cleaved into two daughter cells — a process known as cytokinesis — has fascinated biologists for more than 150 years. In 1891, Walther Flemming published beautiful drawings showing that a cleavage furrow ingresses between separated chromosomes and forms a short intercellular bridge connecting both daughter cells. But how does abscission, the final cut of the intercellular bridge, eventually occur? It was first thought to be a trivial event, but it turned out to be a much more sophisticated and regulated process than initially anticipated.

In 2007, two seminal papers reported that ESCRTs (endosomal sorting complexes required for transport) were essential for the completion of cytokinesis (Carlton et al. and Morita et al.). The activity of the ESCRT machinery culminates with the polymerization of ESCRT-III filaments that were originally known to facilitate the scission of intraluminal vesicles from the limiting membrane of late endosomes. Also known was that retroviruses hijack this machinery at the plasma membrane to promote the budding and release of virions through the deformation of the membrane away from the cytosol. Carlton and Martin-Serrano proposed that cytokinetic abscission is a similar topological event (as if one of the daughter cells was a giant virion) that is driven by the same molecular machinery in human cells.

These studies were influential because it proposed a straightforward mechanism for abscission. Soon afterwards, ESCRTs were implied in

cytokinesis in Archae (Lindas et al.; Samson et al.), suggesting that abscission might be the ancestral function of this ancient molecular machinery. Live cell imaging and tomo-EM later revealed that ESCRT-III accumulates at the abscission site just before the final cut (Elia et al.) and ESCRT-dependent helices ‘pinch’ the membrane (Guizetti et al.).

The discovery of ESCRTs in cytokinesis highlights how “outsiders” can make crucial contributions: the Martin-Serrano and Sundquist groups were virology specialists who hadn’t worked on cytokinesis before.

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