

Impenetrable barriers or entry portals? The role of cell-cell adhesion during infection

Matteo Bonazzi and Pascale Cossart

Vol. 195 No. 3, October 31, 2011. Pages 349–358.

The authors wish to correct an omission of relevant information from a paragraph in their Review. The revised paragraph and newly included references appear below.

The html and pdf versions of this Review have been corrected.

Tunneling nanotubes

A particular type of cell–cell interaction with an emerging role in infection is that mediated by tunneling nanotubes. These are transient, long, cytoskeleton-rich projections that extend from one cell to another and support the intercellular transport of membranes, and even organelles, over relatively long distances (Rustom et al., 2004; Gerdes et al., 2007). The formation of these structures has been observed in vitro between several cell types, including macrophages and immune cells. A study on the morphology and function of tunneling nanotubes has identified the presence of thin and thick nanotubes, the former being enriched in actin and having a diameter of less than 0.7 μm , and the latter containing F-actin and microtubules and having a diameter larger than 0.7 μm (Onfelt et al., 2006; Sowinski et al., 2008). Accordingly, it has been shown that only thicker nanotubes can support the intercellular transport of endosomal and lysosomal vesicles as well as mitochondria, which move along these channels in an ATP-dependent manner with a speed compatible with that of microtubule-based transport (Onfelt et al., 2006). Surprisingly though, thinner, and not thicker nanotubes can mediate the cell-to-cell spread of large particles, such as streptavidin-coated beads or even bacteria, as in the case of *Mycobacterium bovis*, which surf on these tubes, thereby exploiting a constant membrane turnover/dynamics to reach neighboring cells (Onfelt et al., 2006). More recently, tunneling nanotubes have been shown to play a key role for the intercellular spread of prions (Gousset et al., 2009). Prion dissemination through tunneling nanotubes has been observed between neuronal Cath.a-differentiated (CAD) cells as well as between dendritic cells and primary neurons, this latter example providing a possible mechanism for the documented retrograde transport of prions from the intestine to the central nervous system (Gousset and Zurzolo, 2009; Gousset et al., 2009). During viral infections, HIV and murine leukemia virus (MLV) trigger the formation of filopodial bridges that connect infected cells with neighboring non-infected cells, thereby spreading the infection (Sherer et al., 2007; Sowinski et al., 2008; Eugenin et al., 2009; Jin et al., 2009). However, these virus-induced structures are not open-ended (Sherer et al., 2007; Sowinski et al., 2008), suggesting the classification of these cell–cell contacts as cytonemes rather than nanotubes (Sherer et al., 2007).

References

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